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ELEMENTARY TESTS IN PSYCHOLOGY

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## ELEMENTARY TESTS IN PSYCHOLOGY

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It is generally assumed that the blind are keener in hearing and touch than seeing persons are. Many marvel at the performances of the blind who walk about and feel at home, guiding themselves without the use of their eyes; and, when the blind person reads his braille with his finger-tips approximately as fast as we read with our eyes, they feel thoroughly convinced that here is a case of compensation in sensitiveness: in the absence of sight, his ear and his finger-tips have become more sensitive, for a seeing person is comparatively helpless in guiding himself by hearing or touch.

Through years of experience in the laboratory, the conviction has gradually grown upon me that a more radical distinction should be made between sensitiveness and ability to use a sense; *i. e.*, between inborn sensory capacity and acquired ability or skill. From time to time I have taken the opportunity of comparing my own sensitiveness in touch and hearing with that of blind persons distinguished for ability in guiding themselves by hearing and touch; and in no case did I find that the blind persons possessed any significant superiority to myself in sensitiveness to touch and hearing, although some of the blind persons experimented upon were noted for their wonderful performances through hearing and touch.

For about fifteen years we have been collecting data in the Iowa laboratory on the features involved in pitch discrimination; and, although we started out with all previous records and theories to the contrary, it has been abundantly proved that the test of pitch discrimination may be so elemental that there can be no improvement with practice and there will appear no significant variation with age, say from the age of eight to forty. So far as I know these data are the first clear-cut demonstration of the fundamental distinction which I wish to bring out here, namely, the distinction between psycho-physic sensibility and the apperceptive use of a sense.







We may say that a test is *elemental* when it is so simple and direct that no improvement can be made in the record by training. This is a new connotation assigned to the concept "elemental," for want of a better word. It follows from this definition that, within self-evident bounds, the record of an elemental test should not vary with age or phenomenal use of the sense.

It is evident that if such elemental tests are possible, the introduction of this concept into individual psychology must be of very great importance.

With this in view, we have undertaken in the Iowa laboratory to seek verification of this principle by two distinctive lines of experiment: first, by measurement of the effect of extraordinary use of a sense not ordinarily employed as in the case of hearing and touch by the blind; and, second, by a prolonged series of training in a test which is presumably elemental. The full account of these two experiments will be published in Volume VII of the University of Iowa Studies in Psychology. Here I shall merely announce the general conclusions and point out the practical significance of these facts for educational psychology.

## I. THE COMPARATIVE SENSITIVENESS OF BLIND AND SEEING PERSONS

(Experiments by Tsoerum Ling)

The fifteen brightest pupils of high school grade who had been blind for more than five years were selected in the Iowa School for the Blind at Vinton. These were compared with fifteen pupils in the Iowa City high school, selected at random—merely by taking those who happened to have a convenient schedule for the experiments. On these two groups six measurements in touch, hearing, and the kinaesthetic sense were made, which are so simple and direct that they might prove elemental so far as this test would constitute any evidence. These tests were: (1) discrimination for the direction of sound, (2) discrimination for intensity of sound, (3) discrimination for lifted weight, (4) discrimination for passive pressure, (5) discrimination for active pressure, and (6) discrimination for two points in tactual space. Most painstaking efforts were made in the adaptation of apparatus and method to make these six measurements elemental by reducing them to simple, direct impression which could be reported by the most natural response, no skill in action of any kind being involved. In other words, the aim was to establish a

physiological threshold as distinguished from a cognitive threshold.


The physiological threshold is the actual psycho-physic limit of the organism as measured under the most favorable conditions—conditions so simple and direct that they may be complied with adequately without training. The cognitive threshold, on the other hand, is any threshold that is inferior to the physiological on account of lack of skill or some cognitive or other difficulty which might be overcome by information or training.

The general result of these accurate measurements on fifteen blind and fifteen seeing persons in groups of approximately the same age are easy to generalize: *The threshold of sensory discrimination in each of these six measurements is about the same for the seeing group as for the non-seeing group.* There are certain variations, for individuals as well as for the group, but they are fairly distributed on the two sides so as to justify the general statement just made.

In the light of popular opinion, in the light of the opinion of those who are specialists in the training of sensory defective, as well as from the point of view that has generally been taken in psychological measurements on individual differences, this result is rather astonishing. Yet when one considers the case in its true setting, it seems natural enough.

We are born with prodigious resources of which the psycho-physic organism for sensory discrimination is a good illustration. We have so many avenues leading to the same goal, so many means of accomplishing the same object in sensory experience, that no individual, however accomplished, makes use of more than a very small portion of his native capacity for sensory discrimination in clearly conscious terms. The eye seems to be the most convenient and universal avenue of approach to the outer world; therefore, seeing persons use their eye in apprehending objects and *store up their experiences and form their habits* in terms of eye adjustments. Other sensory impressions accompany these and may substitute for them but ordinarily take a secondary role.

Under these circumstances two facts are to be noted: first, we have no evidence, experimental or otherwise, to prove that the psycho-physic capacity of the eye is enhanced by persistent use in the life of the individual; that is, the refractive system does not improve by practice and the retina probably does not become



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more sensitive to color and brightness by use, although the meaning of impressions may grow enormously by training. And, second, we have no evidence, experimental or otherwise, to show that the ear and the tactual organs in the skin and muscles become less sensitive by non-use in *apperception* in the life-time of an individual so long as sense-stimuli are allowed to play upon these organs in a normal manner.

Take the case of the blind and the seeing, then. The blind store their experiences and carry their psycho-motor adjustments in other terms than sight. They use hearing, touch, and all the other lower senses more than seeing persons do, but we have no evidence to prove that the basilar membrane (or any other mechanism) or the sense organs of any of the other senses are improved by such use. On the other hand, the experimental evidence here reported goes to show that native sensitivity, including both sensitivity and sensory discrimination as ordinarily used, remains constant under such conditions, other things being equal.

But it may well be claimed that even the most elemental of these tests involves a certain amount of power of observation which has been acquired by training. This is true, and for this reason no test can be made absolute. A child cannot react until his general power of application has developed to such an extent that he can say that he hears or does not hear, sees or does not see, a particular object placed before him and can do this with adequate application to the task. But the point is that this general ability involved in elementary sensory discrimination is so instinctive and so direct and simple that every normal child exhibits that ability very early. In the case of pitch discrimination, *e. g.*, we have found that, with bright children, such a satisfactory elemental test can be made at the age of five, while the dull child may not have acquired that ability at the age of ten.

If we ask, then, for an interpretation of the facts before us, it may probably be summed up in this: that the elemental sensory discrimination as one feature in the mechanism of the psychophysic organism is so thoroughly established through geological ages of adjustment that the extraordinary use of it in a single lifetime will not materially change its capacity. Learning, which represents stored-up experience, with the power of reproduction and elaboration, may shift from one sense to another in response

to the exigencies in the life of the individual without disturbing the relative sensitivity of the organs involved in all normal sensory life, and all the senses are continuously at play sufficiently to prevent a deterioration.

Indeed, these sensory discriminations manifest themselves in all the senses very early in infancy. I have observed four infants during the first ten days with reference to their localization of sound; and in all four cases a surprising ability to observe the direction of a source of sound was present as soon as the infant began to notice sound at all. The fact that this process is automatic makes it possible for us to use the sense of hearing in normal life without being aware of the actual extent to which we do use it.

The interpretation here given to immediate sensory discrimination makes necessary a revision of the conventional distinction between sensitivity and discrimination in experimental psychology. Ordinarily, discrimination is used in the sense of a judgment; but in the case of the elemental measurements here involved, the reflective process is reduced to a minimum and the test becomes essentially one of immediate sensory impression allied to that of bare sensitivity.

## II. THE EFFECTS OF PRACTICE ON DISCRIMINATION FOR THE INTENSITY OF SOUND

(Experiments by Kwei Tan)

The above results of trials with the six tests do not constitute complete proof of the elemental character of these tests, although they point very strongly in that direction. The conditions under which they were given may, however, be considered fairly crucial. In order to get further specific proof in regard to the elemental character of these tests, an extended study was made on one, namely, the discrimination for the intensity of sound. The problem was merely this. The observer hearing two tones, one second apart, each lasting one second, was asked: Which was the louder?

Mr. Tan, having trained himself in the manipulation of this test, and having fitted it up in the sound, light, and jar-proof room of the laboratory, took thirteen advanced students and put them through a series of exercises consisting of the repeti-





tion of these measurements, determining how small a difference in the intensity of sound the observer could detect. This was the most effective form of training we could devise. Six of these observers continued under approximately uniform conditions for twenty hour-periods each, and the other six had slightly less, varying from thirteen to seventeen periods of training. In all cases, however, it seemed that the training was long enough to reveal whether or not there was to be any progressive improvement with practice. While there were individual fluctuations and slightly characteristic variations in the so-called practice course for different observers, his general conclusion was that, where we had control of the conditions and there were no disturbing influences present, *this amount of training yielded no evidence of improvement with practice.*

In other words, we have here a test which is elemental in the sense defined above, first, as evidenced by the apparent lack of modification by blindness, and second, by failure to improve with practice.

A third step remains to be taken, namely, to determine whether or not it develops with age. A considerable number of experimenters have made measurements on children and the general conclusion of these experiments is that there is improvement with age. But such was also the finding for pitch discrimination until the most recent experiments. This may perhaps be due to the failure to realize the significance of apparently trivial conditions in the test which will tend to make or unmake it as an elemental test. In other words, for want of experimental proof on children, I would make the prediction that we should probably find that, where the child is old enough to apply himself and does apply himself intelligently to the test—say from five to ten years of age, according to the brightness of the child—the records for these six tests which were tried on the blind would not vary with age.

The findings in these experiments constitute a challenge to a large part of current systems of mental tests. They demand that, before we attribute a developmental trait to a subject, we must ascertain that such a variable is not due to our failure to recognize the significance of making tests of capacity elemental.



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